

**ABSTRACT**

[0060]

Disclosed herein is an apparatus and method for detecting a selected material that change an effective dielectric constant of a circular resonator. An example of the apparatus includes an input waveguide, an output waveguide and a circular resonator. The input waveguide receives electromagnetic wave from an electromagnetic wave source. The circular resonator is located adjacent to the input and output waveguides, which enables the resonator to receive electromagnetic wave from the input waveguide. The circular resonator bonds to a selected material, e.g. chemical gas, chemical liquid, and bio-agent. The selected material can change the effective dielectric constant of the circular resonator, which in turn causes a change in the electromagnetic wave intensity of the circular resonator. The output waveguide receives the change in electromagnetic wave intensity from the circular resonator, which can be used to determine the selected material qualitatively and quantitatively.